Growth of children according to Maternal HIV-status the first year of life in Moshi, Tanzania 2007

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ABSTRACT

***Background*:** More than 2/3 of all people living with HIV live in the sub-Saharan countries. The majority of these people are women and there is an estimate of 12.2 million women of childbearing age being infected with HIV. The objective of our study was to investigate if maternal HIV could have an impact on growth during the first year of life in children born to HIV-positive versus HIV-negative mothers in Moshi, Tanzania.

Method: Data on weight, length and head circumference were collected retrospectively in addition to several socio-demographic variables at two primary health care centers in Moshi. We went through 1641 files of pregnant women attending for routine antenatal care and out of these 1477 women met our criteria of inclusion.

Results: Groups of girls and boys of various numbers had their weight, body length and head circumference registered at 3, 6, 9 and 12 months after birth. Of these were most born to HIV-negative mothers and some to HIV-positive mothers.

132, 33 and 35 girls had their weight, length and head circumference registered at all time points, respectively. The difference in mean weight, length and head circumference varied at different time points and the differences were of no statistical significance ($p>0.05$).

169, 50 and 52 boys had their weight, length and head circumference measured at all time points, respectively. As for the girls, the differences in means varied at different time points and the differences were of no statistical significance ($p>0.05$).

Of the socio-demographic factors included in our study, there were only minor differences between the HIV-positive and HIV-negative mothers.

***Conclusion*:** We found no significant statistical difference between the children of the HIV- positive and HIV-negative mothers. There is reason to question this result due to lack of standardized routines, poor attendance and a small material. Difficulties are encountered when conducting studies in developing countries which remain a challenge in the future and especially important is the education of health workers and the implementation of standardized routines.

1.0. INTRODUCTION

1.1.Tanzania and HIV

On the east coast of Africa lies the United Republic of Tanzania, one of the poorest countries in the world with 35 % of its 38 329 000 citizens living below the basic needs poverty line (1). The life expectancy at birth is only 45,5 years for men and 47,5 years for women. (2) One of the great public health concerns is the unequal access to social services which is mainly due to uneven income distribution, high levels of poverty and a non-functional social protection system for the poor (1).

In 2007 33.2 million people in the world were living with HIV. Of these were 2.5 million children. The Sub- Saharan countries remain the most affected region and more than two-thirds of all people living with HIV live in this region. The majority (61 %) of these people are women and there is an estimate of 12.2 million women of childbearing age being infected with HIV. (3). Not only is there a risk of transmitting HIV from mother to child but we were interested in seeing if maternal HIV could have an impact on growth the first year of life in children born to HIV-positive vs. HIV-negative women.

1.2.HIV and MTCT

In our context the knowledge of how the HIV-1 virus is transmitted from mother to child (MTCT) is interesting. The reported rates of transmission of HIV-1 from infected mother to infant have ranged from 14-64%. The overall rate in Africa is about 35%. The HIV-1 virus can be transmitted in utero, during delivery or postnatally through breast milk. Most infections occur during late pregnancy or peripartum. The women who have recently acquired the virus or are in a late stage of the disease are at greatest risk of vertically transmitting the virus. Other risk factors for transmission to the infant are premature delivery, vitamin A deficiency of the mother, maternal smoking etc. Intrapartum transmission is through exposure of the infant to cervical and vaginal secretions or maternal blood. There is a 15% additional risk of transmitting HIV through prolonged breastfeeding for HIV-positive mothers. (4)

1.3. Growth

There are three phases of growth; fetal, childhood growth and the pubertal growth spurt. Fetal growth is the most rapid phase and controlling factors include the supply of nutrients, oxygen and several local growth factors. In childhood growth is linear, still rapid but plateaus through childhood. Controlling factors are genetic determinants, nutrition, hormones and absence of chronic disease(5).

Growth charts are used to demonstrate normal growth. Plotting growth over time has more clinical value than single measurements. Weight-, length- and head circumference-for-age are usually plotted on different charts. Comparing patterns of these parameters over time is useful to detect possible abnormal growth and to outline the cause of the abnormality (5). Weight-for-length charts are particularly useful as length is the better parameter to look at over time and weight for length give a good indication whether the child is particularly underweight or obese (6).

In parts of our report we comment on the WHO growth charts as an international standard for physiological growth for children from birth to 5 years of age. These growth charts were generated using data from 8500 children from different ethnical backgrounds from 1997-2003 (Brazil, Ghana, India, Norway, Oman and the USA).(7)

Lack of nutrients and chronic disease are major causes of failure to thrive in developing countries. Failure to thrive is a concern when the infant's weight is below the 3rd percentile on the growth chart. Of more clinical value is the growth pattern with time, and weight crossing two major percentile lines is worrying. When an infant is failing to thrive there is a typical growth pattern: weight gain is affected first. And if the problem persists the length may also decrease. Only when failure to thrive is severe will the head circumference be affected (6).

1.4. WHO-recommendations on HIV and infant feeding

Breast milk contains factors protecting against bacterial and viral infections. It is rich in energy, has a high proportion of fat and is important for growth and development, especially the brain and nervous system (9).
When it comes to breastfeeding the recommendations from WHO are followed in Moshi, Tanzania. These recommendations are:

- Replacement feeding if acceptable, feasible, affordable, sustainable and safe, avoidance of all breastfeeding by HIV-infected mothers is recommended. Otherwise, exclusive breastfeeding is recommended during the first months of life.
- For the HIV-positive mothers breastfeeding should be discontinued as soon as possible taking into account the local circumstances and the individual woman’s situation and the risks of replacement feeding
- If they choose not to breastfeed they should receive guidance and support for at least 2 years to ensure adequate feeding of the infant.
- All HIV-positive mothers should receive guidance and help to select the best feeding option in their situation.(10)

2.0 METHOD

The project “Better Health for the African Mother and Child” was started in 2002 as a study of Prevention of mother to child transmission of STI` s, including HIV. The project is cooperation between universities and different hospitals in Tanzania, Zimbabwe, UK and Norway (11). In Tanzania this project has led to the funding of, among others, two primary health care centres in Moshi urban district. The last 6 years a large amount of data has been collected in these clinics and our study is based on parts of this information that we gathered during four weeks in Moshi. Details of enrolment and follow-up procedures for the study have been described elsewhere (12).

2.1. Study area and study population

Moshi is the largest of six regions in the Kilimanjaro district in the northern part of Tanzania. It is the capital of the district and has 230 000 inhabitants. The two primary health care centres are situated in two of the poorest areas in Moshi, Majengo and Pasoa. The clinics have the largest number of patients of the primary health care centres in the area, with easy accessibility. The clinics have about 70-100 patients daily and the main tasks are family planning, follow-up consultations of children under the age of 5 and general consultations of mother and child. When further treatment is needed the patients are referred to the tertiary centre at K.C.M.C hospital, also in Moshi. (12). Women who agreed to take part in the study have been followed through the past 6 years, and at each control or consultation adding to the existing information.

After consenting to the project all the women were interviewed and a questionnaire including questions about living conditions and socio demographic variables was answered. In the first year after childbirth all mothers were offered follow-up consultations at 1, 3, 6 , 9 and 12 months which included registering weight, length and head circumference, neuro-development and episodes of illness. Weight was registered using a scale of different type, depending on the child’s age. The child’s length was obtained using a measuring tape from the floor to the vertex. The head circumference was measured using a measuring tape from the occipital protuberance to the supra-orbital ridges on the frontal bone. A general clinical examination of the child was also conducted by physicians and

the mothers were given information about feeding options according to her economical situation and HIV-status. Whenever needed, the women could bring their children for treatment, all services free of charge.

2.2. Our study (study procedures)

The data obtained for the study at the clinics were recorded on colour coded standardized forms i.e. a yellow form for registering data at 3 months etc. We went through 1641 files. Out of these 1477 met our criterias of inclusion. We chose the following variables and collected the data for these:

- Sex of the child
- Weight, length and head circumference at birth, 3, 6,9 and 12 months (all time points +/-14 days)
- HIV- status of the mother
- HIV- status of the child (obtained at 18 months of age)
- Age of mother (up to 19 years or 20 years and above)
- BMI of mother
- Breastfeeding up to 0, 3, 6, or 12 months.
- Marital status (living alone, cohabiting or married)
- Income: 0-30 000 (0-130 NOK), 30 000-100 000 (130 – 430 NOK), >100 000 (> 430 NOK) Tanzanian shillings
- Education (no schooling, < 7 years, >7 years)

2.3. Criteria of inclusion

To be included in our study the HIV- status of both mother and child had to be known, the child had to be the mother` s first baby in the project, and birth weight had to be available. We excluded twins and those children who died before the age of 12 months.

2.4. Analyzing the data and selecting our study group

When analyzing the data we looked at boys and girls separately. This is because boys generally have a higher birth weight, length and head circumference. We did a cross-sectional analysis of weight, length and head circumference at all the time points (0, 3, 6, 9 and 12 months) for all the children and found the mean values of the parameters. We then did a cross sectional analysis of the limited group of children with recording at all time points, for instance only those with

weight registered at ALL time points, and the same for length and head circumference. That means that the study group for weight was a different group than the group for length. There was no difference of statistical significance between the children born to HIV-positive and negative mothers in neither of these two sets of groups. We therefore decided to look at the limited group of children to follow the development over one year.

First we compared the children of HIV-negative mothers to children of HIV-positive mothers (this group includes both HIV-negative and HIV-positive children) before comparing the HIV-negative children of sero-positive mothers to the HIV-positive children. This was to see if having a mother that is HIV-positive has an impact on growth even if the child is HIV-negative the first 12 months of life.

2.5. Growth curves:

The growth curves comparing the development of growth the first year of life for the two groups were made using Microsoft Excel and then converted to fit the format of SPSS.

2.6.Statistical analysis:

The data were analysed using SPSS statistical software version 16.0 for Macintosh. A confidence interval of 95% was calculated to measure the strength of association between the potential effects of HIV-status of the mother on growth. Statistical comparison between groups in the univariate analysis was made using independent -samples T test. The level of significance was set at $p< 0.05$.

2.7.Ethics

Research and ethical clearance for the study had already been given from Tanzanian Ministry of Health and Norwegian Ethical Committee.

3.0. RESULTS

3.1. WEIGHT

A total of 132 girls and 169 boys had their weight registered at all time points (table 1 and 2). Statistical analysis was done on boys and girls separately.

Table 1: Weight of girls according to maternal HIV status.

Time point	Maternal HIV status	N	Mean weight (kg)	SD	p-value	95 % CI lower	95% CI upper
Birth	Neg	118	3,13	0,42			
	Pos	14	3,22	0,58	0,46	-3,41	1,54
3 months	Neg	118	6,05	0,81			
	Pos	14	6,08	0,87	0,9	-4,84	4,28
6 months	Neg	118	7,41	0,96			
	Pos	4	7,53	0,67	0,67	-6,36	4,12
9 months	Neg	118	8,32	1,03			
	Pos	14	8,54	0,71	0,44	-7,83	3,42
12 months	Neg	118	9,13	1,16			
	Pos	14	9,48	1,03	0,29	-9,93	2,95

Table 2: Weight of boys according to maternal HIV status.

Time point	Maternal HIV status	N	Mean weight (kg)	SD	p-value	95 % CI lower	95% CI upper
Birth	Neg	152	3,27	0,42			
	Pos	17	3,22	0,45	0,67	-1,67	2,6
3 months	Neg	152	6,6	0,92			
	Pos	17	6,18	0,71	0,07	-0,39	8,74
6 months	Neg	152	8,02	1,15			
	Pos	17	7,58	0,8	0,12	-1,2	10,1
9 months	Neg	152	8,86	1,19			
	Pos	17	8,41	1,06	0,15	-1,16	10,44
12 months	Neg	152	9,54	0,32			
	Pos	17	9,21	1,1	0,32	-3,22	9,89

Girls. Of all the children 132 girls had their weight registered at all time points. The girls born to HIV-positive mothers (n=14) had a higher weight at all time points than those born to HIV-negative mothers. Our independent samples t-test shows that the difference is of no statistical significance ($p>0.05$) (table 1).

Boys. 169 boys had their weight registered at all time points. Of these were 152 born to HIV-negative mothers and 17 born to HIV-positive mothers. At all time points the boys born to HIV- negative mothers had a higher mean weight than

those born to HIV positive mothers. The independent sample t-test however showed no statistical difference (p>0.05). (table 2)

3.2. LENGTH

A total of 33 girls and 50 boys had their body length registered at all time points (table 3 and 4). These children were not necessarily the same as the children in the group with the recordings of weight. Statistical analysis was done on boys and girls separately.

Table 3: Body length of girls according to maternal HIV status.

Time point	Maternal HIV status	N	Mean length (cm)	SD	p-value	95 % CI lower	95 % CI upper
Birth	Neg	31	48,3	2,09			
	Pos	2	48,0	2,82	0,83	-2,82	3,50
3 months	Neg	31	59,7	2,70			
	Pos	2	61,0	0,00	0,51	-5,26	2,65
6 months	Neg	31	65,9	3,51			
	Pos	2	66,8	1,77	0,73	-6,05	4,25
9 months	Neg	31	70,6	3,03			
	Pos	2	69,2	0,35	0,55	-3,13	5,76
12 months	Neg	31	73,3	4,90			
	Pos	2	73,5	0,71	0,96	-7,33	7,01

Table 4: Body length of boys according to maternal HIV status.

Time point	Maternal HIV status	N	Mean length (cm)	SD	p-value	95 % CI lower	95 % CI upper
Birth	Neg	46	49,1	2,55			
	Pos	4	48,6	0,96	0,77	-2,22	2,98
3 months	Neg	46	61,2	3,17			
	Pos	4	61,5	2,38	0,88	-3,63	2,93
6 months	Neg	46	67,4	3,28			
	Pos	4	65,3	4,19	0,23	-1,37	5,63
9 months	Neg	46	71,3	2,79			
	Pos	4	68,8	1,50	0,08	-0,33	5,42
12 months	Neg	46	74,2	4,35			
	Pos	4	73,5	1,73	0,74	-3,70	5,18

Girls. 33 girls had their length recorded at all time points. Of these were 2 born to HIV-positive mothers. The mean length at birth and 9 months was higher for the girls born to HIV- negative mothers then those born to HIV- positive mothers. The opposite was the case at 3, 6 and 12 months (table 3). The difference between the two groups was of no statistical significance (p>0.05).

Boys. Fifty boys had their length registered at all time points. Four of these were born to HIV- positive mothers. The boys born to HIV-negative mothers (n=46) had a higher mean length at all time points except at 3 months. The difference between the two groups was of no statistical significance (p>0.05) (table 4).

3.3. HEAD CIRCUMFERENCE

A total of 34 girls and 52 boys had their head circumference registered at all time points (table 5 and 6). These were not necessarily the same children as in the groups who had their weight or length registered. Statistical analysis was done on boys and girls separately.

Table 5: Head circumference of girls according to maternal HIV status.

Time point	Maternal HIV status	N	Mean HC (cm)	SD	p-value	95 % CI lower	95 % CI upper
Birth	Neg	32	34,7	1,00			
	Pos	2	35,0	0,00	0,64	-1,81	1,12
3 months	Neg	32	40,6	1,19			
	Pos	2	41,0	1,41	0,64	-2,19	1,36
6 months	Neg	32	43,3	1,44			
	Pos	2	43,3	0,35	0,98	-2,08	2,14
9 months	Neg	32	44,4	1,37			
	Pos	2	45,3	0,36	0,38	-2,88	1,13
12 months	Neg	32	45,0	1,40			
	Pos	2	46,5	0,71	0,14	-3,58	0,53

Table 6: Head circumference of boys according to maternal HIV status.

Time point	Maternal HIV status	Number	Mean HC (cm)	SD	p-value	95 % CI lower	95 % CI upper
Birth	Neg	47	35,0	1,25			
	Pos	5	34,6	0,54	0,44	-0,70	1,59
3 months	Neg	47	41,4	1,51			
	Pos	5	41,4	0,65	1,00	-1,38	1,38
6 months	Neg	47	44,1	1,42			
	Pos	5	43,3	0,98	0,22	-0,51	2,12
9 months	Neg	47	45,6	2,67			
	Pos	5	44,6	1,14	0,44	-1,40	3,39
12 months	Neg	47	46,4	1,86			
	Pos	5	45,6	0,89	0,36	-0,92	2,50

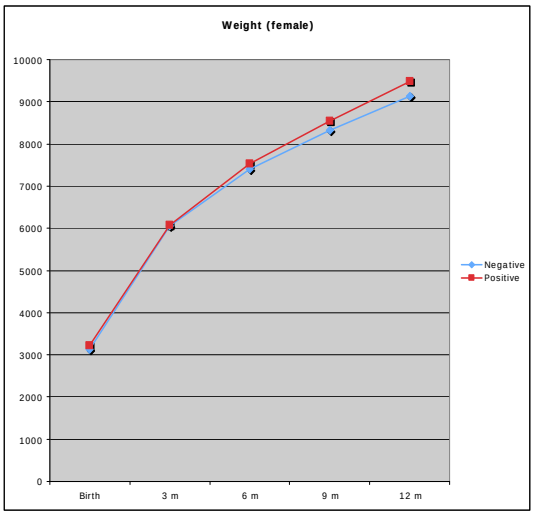
0

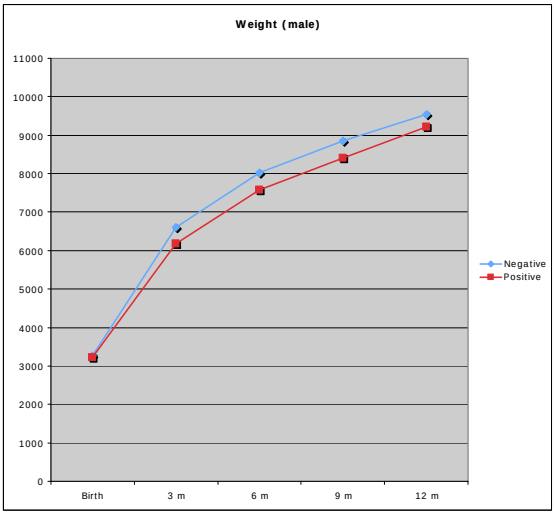
Girls. 34 girls had their head circumference measured at all time points. Of these were 2 born to HIV-positive mothers. The mean head circumference of the girls born to HIV-negative mothers was lower than those born to HIV-positive

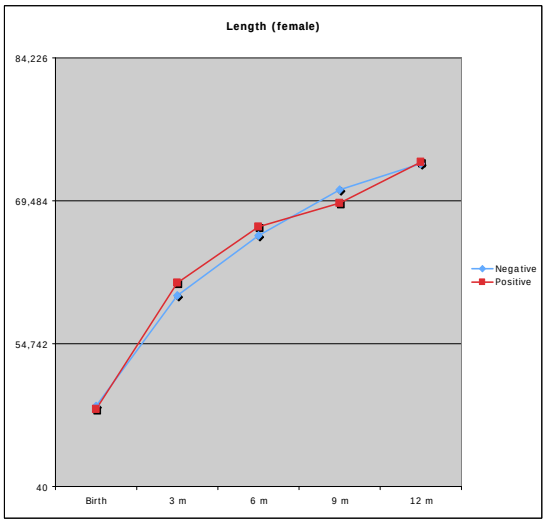
mothers at all time points except at 6 months. The difference, however, was of no statistical significance (p>0.05) (table 5).

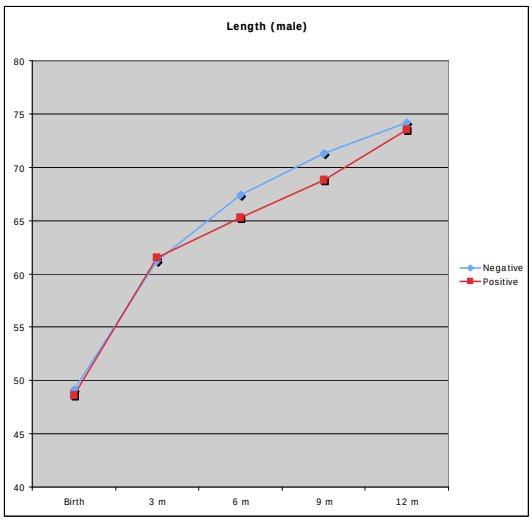
Boys. 52 of the boys had their head circumference registered at all time points. Of these were 5 born to HIV-positive mothers. When comparing the two groups, the boys born to HIV-negative mothers had a larger mean head circumference except at 3 months where there was no difference. The independent sample t-test showed the difference to be of no statistical significance (p>0.05) (table 6).

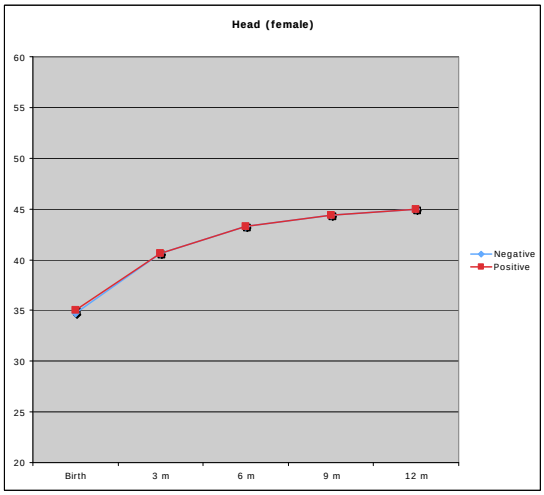
3.4 Curves of weight, body length and head circumference of females and males according to maternal HIV sero-status.

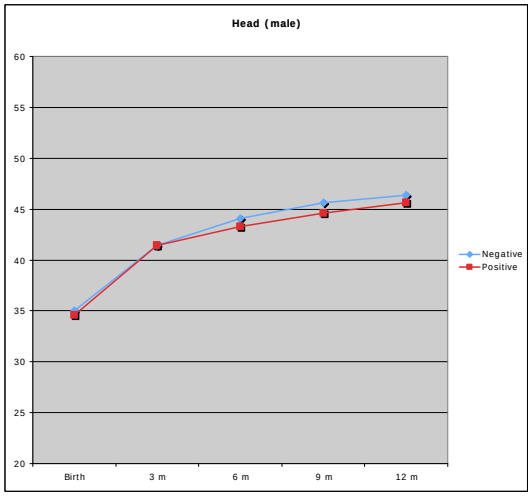












3.5. GROWTH COMPARED TO THE WHO-STANDARD GROWTH CHARTS

We did a cross sectional analysis of all the children born to HIV-negative and HIV-positive mothers at each time point and compared the mean weight, length and head circumference of the two groups with the WHO standard growth charts. This was to get a broader overall picture of the growth of children in the project compared to the international standards. We found little difference among the children born to HIV- positive and HIV- negative mothers. The mean numbers of both groups were mostly on the same percentile with minor deviations. This applied to weight, length and head circumference. For weight neither of the groups fell below the 3rd percentile and they did not cross two percentiles in the course of their first year. This gives an indication that the average child attending the clinics in Majengo and Pasoa , Moshi did not have signs of failure to thrive. The length of both girls and boys in the two groups was from the 25th percentile and above and hence shows that the average child was not stunted. (stunted: below the fifth percentile of the length compared to the growth reference population) (13) For head circumference all the children were within the normal range.

3.6. SOCIO-DEMOGRAPHIC FACTORS

Socio-demographic factors were collected from the 1477 mother/child files included in our report.

Table 7: Maternal factors

		HIV-POS MOTHERS		HIV-NEG MOTHERS	
		Number	% of HIV pos	Number	% of HIV neg
Age	>20 years	99	93,4	1050	81,1
	<20 years	7	6,6	244	18,9
Marrital status	Living alone	16	15,2	141	10,9
	Cohabiting	53	50,5	759	58,5
	Married	36	34,3	398	30,7
BMI	<19	37	3,3	4	3,9
	20-25	542	48,1	52	50,5
	25-30	441	39,2	39	33
	>30	101	9	3	12,6
Education	No schooling	3	2,9	56	4,3
	< 7years	89	85,6	1104	85,3
	>7 years	12	7,5	134	10,4
Income	<30 000	79	86,8	918	93,5
	30-100 000	10	11	58	5,9
	>100 000	2	2,2	6	0,6
Breastfeeding	no breastf.	7	6,6	2	0,2
	3 months	30	28,3	47	3,8
	6 months	21	20,2	185	14,9
	1 year	46	44,2	1009	81,2

4.0 DISCUSSION

4.1. METHOD

-Sources of error-

Selection of our study group

When we chose to look at only the children with recordings at ALL follow up time points this might have given rise to bias. These mothers may have been more conscious about attending the follow-up consultations than were the other mothers. They may also differ in other aspects of health-seeking behaviour. Hence the study population would not be representative for the whole population. On the other hand we tested the difference between children of HIV-positive mothers versus HIV-negative mothers for the data on 1477 mother/child pairs first, and found that the group of 270 mother/child pairs was no significant different than the larger group.

Collecting the data

One of the most important sources of error in our study is how the data was collected. It soon came apparent that the way the children were measured was far from a standardized procedure and a significant source of error:

Weight: The scales used were old and hardly ever calibrated. This gives rise to error although systematic. In addition to this the accuracy of recording the results varied greatly. Some would note 7 kg where as others would write 6,5 kg, registering the same weight. This makes the measurements operator dependent and a source of arbitrary errors.

Some of the data collected in the project were from home-visits done by one of the nurses. We are not sure how the weight was measured at these home visits but if they used a different scale at these occasions this is an additional source of error. However the frequency of home visits was not high.

Length: The children's length was measured using a measurement tape. We noted that the nurses had different techniques when measuring the baby's length. Some would measure when the baby was fully stretched out on the floor whereas others would do it less accurately when the baby was not fully stretched, measuring when the baby was sitting for example. This gives rise to operator

errors.

Head circumference: The same applies to head circumference. The actual circumference measured is dependent on the measuring technique of the nurse.

Attendance: The follow-up consultations were scheduled at 1,3,6,9 and 12 months. However, just a small proportion of the women attended at these exact time points, and we decided to include women who attended up to 14 days before or 14 days after the estimated time for follow-up. This makes the data obtained at each time point less reliable and comparable and the weight can differ substantially if you consider a baby measured at 3.5 months or at 4.5 months. The reasons for not showing up at the right time were varied; living far from the clinics, having difficulties with transportation, being ill etc. We could have made the time interval narrower but this would have led to a substantial decrease in number of women included in our report.

Very few children had length, weight and head circumference recorded. This was due to few mothers attending all the consultations and although they showed up at all of the agreed time points, not always was weight, length and head circumference measured. This resulted in a very small material for us to compare. This was especially the case for the HIV-positive children since there was as few as 1-4 children in this group. This makes the impact of extreme values much greater than if the material had been larger. Hence the validity of the results is less reliable and less likely to reflect the real picture.

We did not have any information on the mother` s gestational age at the time of delivery but the premature deliveries were always referred to the tertiary centre at K.C.M.C hospital. Therefore the difference this may have contributed to in weight, length or head circumference would be small and probably less important in this context.

Criteria of inclusion

The reason for choosing the mother's first born baby in the project was that being in the project might alter the women's health seeking behaviour and therefore not be representative for the population in general.

Criteria of exclusion

The children with no birth weight registered were excluded and so were the children without a known HIV-status. The children were tested at several time points to see if they were HIV-positive, the result at 18 months being regarded as the earliest reliable one. Therefore only the children who lived up to and took part in the project until 18 months of age were included in our study. This makes the certainty of the HIV status greater than it would otherwise be. The weight of these children might have reduced the mean values of weight, length or head circumference in this group if they had been included in our study group. Stillbirths were also excluded in our study.

Twins were not included in our study as the early growth of normal twins differs significantly from that of singletons and the singleton reference value does not reflect the growth of twins (14).

4.2. Results

The comparison of the two groups

The statistical analysis shows that there is no statistical difference between the children born to HIV-positive and negative children in weight, length or head circumference at any time point. The reason for the lack of difference among the two groups could be several: Possible sources of error (discussed above) and other possible reasons will be discussed in the following.

The consultations and information retrieved is done in a scientific purpose as a part of the project. The health workers are employed as project workers and they have been given instructions on how to obtain and give information to the women who agreed to participate in the project. The setting is therefore somewhat arbitrary and one might question the applicability of our results to the general population both in Moshi and in Tanzania as a whole. It is natural to assume that more time and thorough information are given to the women in the project than would have been done in a normal clinical setting. This is probably especially the case for the HIV positive mothers who we can assume is devoted even more time and given more information than the HIV negative mothers. We know from talking to the health workers at the clinics that this group of women in particular is given information on breastfeeding and nutritional supplements. It is natural to assume

that they also are given more information about signs and symptoms of common childhood illnesses which may contribute to the women seeking medical assistance more promptly then the HIV-negative women.

Another factor in line with the above could be that the HIV positive mothers are more aware of the information given to them and may be following advice more consciously. It may also be reason to believe that they are more aware of the general health of their child, which may for example lead to more prompt visits to the clinic and thus earlier medical intervention. We know for instance that malaria and helmintic infections like hook worms are important limiting factors in the child's growth (15) and the earlier medical intervention the less impact on growth.

One important aspect is that this material includes only the surviving children. These children are the most resilient and it is natural to assume that if the children who died from HIV were included in our result would have been different with regards to growth.

4.3 Sociodemographic factors

Maternal factors:

The questionnaires from inclusion consultations of the pregnant mothers included socio-demographic information. We chose to look at (table 7 p.16):

***Age*:** We were interested in seeing if age could influence on the child`s weight, length or head circumference. We found that the majority of women were 20 years and older in both groups. Some studies (18) have shown that age, socio-economic status etc. have no detectable effect on the child`s growth in the first two years of life. It is difficult to say whether the age is important in our study group where age was not a factor that differed much between the women. An interesting finding is that there seems to be a higher prevalence of HIV-positive women in the older age group and that the younger generation of women are not infected with HIV. This may indicate that strategies for preventing HIV-transmission among teenagers are succesful.

***Marital status*:** Some studies have reported that there is a higher odds-ratio of having a low-birth weight baby when cohabiting or single compared to being

married (1.28, 1.26 and 1.00 respectevily)(19). Cohabiting means that the male partner may have sexual relations to other women in addition to the one he shares his home with. This increases the risk of other STI` s and perhaps less financial support of the individual woman. In our study though, there were fewer married in the HIV-negative group than in the HIV-positive group (30,5% versus 34%).

Maternal BMI: The measurement of pre-pregnancy weight and poor weight gain during pregnancy can give an indication of low birth weight, as it is an indication of low maternal energy intake and therefore less available energy to support fetal growth. (Methods based on calculated pre-pregnancy BMI are used) (16). HIV-positive women tend to have lower weight gain during pregnancy (17) The files at the clinic had only one measurement of maternal weight registered, and it was unclear at what point during the pregnancy this measurement was done. Therefore it gives us no information about the energy intake and hence little information on possible influence on the birth weight and infant growth.

Education**:** A study from 2001 in Tanzania showed that literacy influenced the odds-ratio for low birth weight among HIV-infected pregnant women in Tanzania(18). It has been shown that schooling from 4-5 years seems to be the minimum required to influence health-seeking behaviour (19). With this in mind and the fact that it is common for the Tanzanian children to complete 7 years of schooling we chose to divide the groups in three. Seeing that there is not a big difference between HIV-negative and HIV-positive mothers with regards to level of education (84% versus 84.5% schooling under 7 years respectively) the importance of this factor is difficult to evaluate in our study.

Income**:** Not all women answered the question about what their income was. We were told this was probably because they had income that varied and hence could not be estimated. Also, most often the husband is the main earner. The woman's own income would therefore be 0-30,000 Tanzanian shillings (0-130 NOK) even if the husband had a higher income. A better picture of the family`s living conditions would be to look at their water supply, the toilet facilities or factors that would influence the frequency of infections. The family`s income may influence the mother`s feeding options especially when it comes to breastfeeding versus formula feeding for HIV-positive mothers.

Breastfeeding. As we expected HIV-positive mothers stopped breastfeeding at an earlier time than did the HIV-negative mothers. Still as many as 44,4 % of the HIV-positive mothers were breastfeeding at 12 months (compared to 81,2 % of the HIV-negative mothers). This shows that a lot remains to be done when it comes to convincing HIV-positive mothers to avoid breastfeeding. The differences in breastfeeding do not explain why there is no statistical difference in growth between the two groups of children. We do not know what kinds of supplements were used instead of breast milk. It would have been interesting to know the percentage of mothers who used recommended formulas or cow milk as these two options are not viewed as equally satisfactory as sources of nutrition the first year of life (9).

Stage of HIV-disease

Studies have shown the risk of low birth weight to be higher in women with HIV-stage II and III disease than stage I disease(20). It would have been interesting to know the mother`s disease stage at birth and throughout the first year of their child`s life. Studies have suggested that the disease status of the HIV-infected mother compromises her ability to care for her infant. They suggest that the care-taking abilities are impaired by the HIV-related disease which lead to increased risk for undernutrition and sickness leading to delayed growth progression. (18). It may be that the HIV- positive mothers in our report were in an early stage of the disease and that their care-taking abilities are not impaired compared to the HIV-negative mothers. There is especially reason to believe this since the mothers were healthy enough to bring their children to all visits.

5.0 CONCLUSION

The results from our study showed no differences of statistical significance in growth as measured by weight, length and head circumference between the children born to HIV-positive and HIV-negative mothers in the first year of life. This was the case for both boys and girls. There is reason to question the reliability of this result. The study group was small and extreme values will therefore have a larger impact. Lack of standardized routines of measuring and registering weight, length and head circumference contribute to the unreliability of this result.

Our project reflects the many difficulties one may encounter when conducting studies in developing countries. These difficulties remain a challenge also in the future, especially the education of health workers and implementation of standardized routines in clinical projects in Africa.

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